WHAT IS CLAIMED IS:

1. An engaging force control device of a lockup clutch for use with a torque converter for a vehicle, the lockup clutch engaging a pump impeller connected to the engine with a turbine runner connected to an input shaft of an automatic transmission according to an engaging force, comprising:

a sensor which detects an engine rotation speed ($EngREV$);

a sensor which detects an input rotation speed ($PriREV$) of the automatic transmission;

an engaging force regulating mechanism which regulates the engaging force of the lockup clutch; and

a programmable controller programmed to:

calculate a relative rotation speed (ω_{SLPR}) of the pump impeller and the turbine runner from the engine rotation speed ($EngREV$) and the input rotation speed ($PriREV$) of the automatic transmission;

compare an initial engine rotation speed (ST_EREV) which corresponds to an engine rotation speed when control of the engaging force is started, with a predetermined target engine rotation speed (TGT_EREV);

set a target relative rotation speed (ω_{SLPT}), when the initial engine rotation speed (ST_EREV) is equal to or greater than the predetermined target engine rotation speed (TGT_EREV), according to a difference between the target engine rotation speed (TGT_EREV) and the input rotation speed ($PriREV$) of the automatic transmission;

set the target relative rotation speed (ω_{SLPT}), when the initial engine rotation speed (ST_EREV) is smaller than the predetermined target engine

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rotation speed (TGT_EREV), to gradually vary from an initial relative rotation speed (ST_EREV) which corresponds to the relative rotation speed (ω_{SLPR}) of the pump impeller and the turbine runner when control of the engaging force is started, to a predetermined target change-over relative rotation speed (CHG_SREV); and

control the engaging force regulating mechanism such that the relative rotation speed (ω_{SLPR}) coincides with the target relative rotation speed (ω_{SLPT}).

2. The engaging force control device as defined in Claim 1, wherein the controller is further programmed to set the predetermined target change-over relative rotation speed (CHG_SREV) to equal a fixed relative rotation speed (CHG_SREV_SET) when the initial relative rotation speed (ST_SREV) is equal to or greater than the fixed relative rotation speed (CHG_SREV_SET), and to set the predetermined target change-over relative rotation speed (CHG_SREV) to equal the initial relative rotation speed (ST_SREV) when the initial relative rotation speed (ST_SREV) is smaller than the fixed relative rotation speed (CHG_SREV_SET).

3. The engaging force control device as defined in Claim 1, wherein the controller is further programmed to calculate a target input rotation speed (CHG_PREV) by subtracting the target change-over relative rotation speed (CHG_SREV) from the target engine rotation speed (TGT_EREV), compare the input rotation speed ($PreREV$) with the target input rotation speed (CHG_PREV), and set the target relative rotation speed (ω_{SLPT}) to equal a difference between the target engine rotation speed (TGT_EREV) and the input rotation speed ($PriREV$) when the input rotation speed ($PriREV$) is equal to or greater than the target input rotation speed (CHG_PREV).

4. The engaging force control device as defined in Claim 1, wherein the controller is further programmed to set a time constant initial value (ST_TC), when the initial engine rotation speed (ST_EREV) is greater than the target engine rotation speed (TGT_EREV), to a larger value than a time constant initial value (ST_TC) that is set when the initial engine rotation speed (ST_EREV) is smaller than the target engine rotation speed (TGT_EREV), set a time constant (Tc) to a value which decreases from the time constant initial value (ST_TC) as time elapses from when the control of the engaging force is started, calculate a target relative rotation speed correction value (ω_{SLPTC}) by applying a first-order delay processing to the target relative rotation speed (ω_{SLPT}) under the time constant (Tc), and control the engaging force regulating mechanism to cause the relative rotation speed (ω_{SLPR}) to coincide with the target relative rotation speed correction value (ω_{SLPTC}).

5. The engaging force control device as defined in Claim 1, wherein the controller is further programmed to set the time constant initial value (ST_TC) to equal a predetermined maximum value (ST_TC_MAX) when the initial engine rotation speed (ST_EREV) is equal to or greater than a sum of the target engine rotation speed (TGT_EREV) and a predetermined maximum deviation ($EngERR$), set the time constant initial value (ST_TC) to equal a predetermined minimum value (ST_TC_MIN) when the initial engine rotation speed (ST_EREV) is smaller than the target engine rotation speed (TGT_EREV), and set the time constant initial value (ST_TC) to a value between the predetermined maximum value (ST_TC_MAX) and the predetermined minimum value (ST_TC_MIN) according to a difference between the engine rotation speed ($EngREV$) and the target engine rotation speed (EGT_EREV)

when the initial engine rotation speed (ST_EREV) is equal to or greater than the target engine rotation speed (TGT_EREV) and smaller than the sum of the target engine rotation speed (TGT_EREV) and the predetermined maximum deviation ($EngERR$).

6. The engaging force control device as defined in Claim 1, wherein the engaging force control device further comprises a throttle sensor which detects an throttle opening of the engine, and the controller is further programmed to set the target engine rotation speed (TGT_EREV) to increase as the throttle opening (TVO) increases.

7. The engaging force control device as defined in Claim 1, wherein the automatic transmission is arranged to upshift at a predetermined first speed ($VSP1$), the engaging force control device further comprises a throttle sensor which detects an throttle opening (TVO) of the engine and a vehicle speed sensor which detects a vehicle speed (VSP), and the controller is further programmed to set the target relative rotation speed (ω_{SLPT}) according to the throttle opening (TVO) when the vehicle speed (VSP) is greater than the predetermined first speed ($VSP1$).

8. The engaging force control device as defined in Claim 7, wherein the controller is further programmed to set the target relative rotation speed (ω_{SLPT}) to zero revolutions per minute, when the vehicle speed (VSP) is larger than a predetermined second speed ($VSP2$) which is larger than the predetermined first speed ($VSP1$).

9. An engaging force control device of a lockup clutch for use with a torque converter for a vehicle, the lockup clutch engaging a pump impeller connected to

the engine with a turbine runner connected to an input shaft of an automatic transmission according to an engaging force, comprising:

means for determining an engine rotation speed (*EngREV*);

means for determining an input rotation speed (*PriREV*) of the automatic transmission;

means for regulating the engaging force of the lockup clutch;

means for calculating a relative rotation speed (ω_{SLPR}) of the pump impeller and the turbine runner from the engine rotation speed (*EngREV*) and the input rotation speed (*PriREV*) of the automatic transmission;

means for comparing an initial engine rotation speed (*ST_EREV*) which corresponds to an engine rotation speed when control of the engaging force is started, with a predetermined target engine rotation speed (*TGT_EREV*);

means for setting a target relative rotation speed (ω_{SLPT}), when the initial engine rotation speed (*ST_EREV*) is equal to or greater than the predetermined target engine rotation speed (*TGT_EREV*), according to a difference between the target engine rotation speed (*TGT_EREV*) and the input rotation speed (*PriREV*) of the automatic transmission;

means for setting the target relative rotation speed (ω_{SLPT}), when the initial engine rotation speed (*ST_EREV*) is smaller than the predetermined target engine rotation speed (*TGT_EREV*), to gradually vary from an initial relative rotation speed (*ST_EREV*) which corresponds to the relative rotation speed (ω_{SLPR}) of the pump impeller and the turbine runner when control of the engaging force is started, to a predetermined target change-over relative rotation speed (*CHG_SREV*); and

means for controlling the engaging force regulating means such that the

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relative rotation speed (ω_{SLPR}) coincides with the target relative rotation speed (ω_{SLPT}).

10. An engaging force control method of a lockup clutch for use with a torque converter for a vehicle, the lockup clutch engaging a pump impeller connected to the engine with a turbine runner connected to an input shaft of an automatic transmission according to an engaging force regulated by an engaging force regulating mechanism, the method comprising:

determining an engine rotation speed (*EngREV*);

determining an input rotation speed (*PriREV*) of the automatic transmission;

calculating a relative rotation speed (ω_{SLPR}) of the pump impeller and the turbine runner from the engine rotation speed (*EngREV*) and the input rotation speed (*PriREV*) of the automatic transmission;

comparing an initial engine rotation speed (*ST_EREV*) which corresponds to an engine rotation speed when control of the engaging force is started, with a predetermined target engine rotation speed (*TGT_EREV*);

setting a target relative rotation speed (ω_{SLPT}), when the initial engine rotation speed (*ST_EREV*) is equal to or greater than the predetermined target engine rotation speed (*TGT_EREV*), according to a difference between the target engine rotation speed (*TGT_EREV*) and the input rotation speed (*PriREV*) of the automatic transmission;

setting the target relative rotation speed (ω_{SLPT}), when the initial engine rotation speed (*ST_EREV*) is smaller than the predetermined target engine rotation speed (*TGT_EREV*), to gradually vary from an initial relative rotation speed (*ST_EREV*) which corresponds to the relative rotation speed (ω_{SLPR}) of the pump impeller and

the turbine runner when control of the engaging force is started, to a predetermined

target change-over relative rotation speed (CHG_SREV); and

controlling the engaging force regulating mechanism such that the relative

rotation speed (ω_{SLPR}) coincides with the target relative rotation speed (ω_{SLPT}).